

mineral waters. There are 1027 sources which are worked. Of these 319 are sulphurous, 357 alkaline, 136 iron, and 215 salt; 386 are cold, that is to say, they do not exceed 15° C. in temperature, and 641 are thermal. They are distributed as follows:—Puy-de-Dôme, 94; Ardèche, 77; Vosges, 76; Ariège et Pyrénées Orientales, 69; Hautes-Pyrénées, 64. The paper also states the number of visitors to these different waters. It appears that the Hautes-Pyrénées are the most frequented. During the past year this department alone has had 44,476 visitors, thus distributed:—Puy-de-Dôme, 18,619; l'Alliers, 16,430; la Haute-Garonne, 14,230; les Landes, 12,954. The water flowing from all the 1027 sources is estimated at 46,412 litres per minute.

THE Chevalier Frédéric Franchetti, engineer at Leghorn, has referred M. de Parville to a curious passage in Galileo's "Dialogues" touching a possible early origin of the electric telegraph. In the dialogue Sagrado says that he calls to mind a man who wanted to tell him a secret which would give him the power by means of a certain sympathy of magnetised wires to speak to any one two or three thousand miles off. The bargain however fell through, as the inventor would not try any shorter distance, and Sagrado declined to go to Cairo or Muscovy to try the experiment. The story is told in the last number of the *Revue Scientifique*. The reference given is p. 97 of the first day, Leghorn Edition, 1874.

THE Executive Committee of the International Fisheries Exhibition has published a penny plan and tour as a complete guide to the leading and most interesting features of the Exhibition, which we think will prove useful.

WE have some very interesting figures before us comparing the different modes of illumination in respect to the amount of products of combustion:—

Light of 100 candles.	Products per hour.		
	Water vapour, kilos.	Carbonic acid in cubic metres.	Heat in calories.
Electric lamp, arc	0	0	57-158
„ „ incandescent	0	0	290-536
Gas, Argand burner	0.86	0.46	4860
Lamp, petroleum, flat flame... ..	0.80	0.95	7200
„ colza oil	0.85	1.00	6800
Candle, paraffin	0.99	1.22	9200
„ tallow	1.05	1.45	9700

These we think are quite sufficient to show the great supremacy of electric lighting over all other methods of illumination when considered as a matter of health.

WE learn from *Nature* that a hitherto unknown form of the potato disease, which had been making slow but steady progress near Stavanger during the last ten or twelve years, has recently begun to show increased energy. The stalk of the plant is the part affected, and here Herr Anda has discovered small white fungoid growths, which after a time assume a greenish, and finally a black, colour, after attaining the size of a small bean. While the fungus is rapidly increasing at the expense of the plant, the interior of the stem is first reduced to a pulpy condition, and next shrivelled and hollowed out, until nothing remains but a mere outer shell, which breaks down on being touched. When the ripe black germs of the fungus have remained in the earth through the winter, they are found after the return of the next year's warmth to have developed small stalked fruits filled with minute spores, which penetrate into the young plants before they appear above the ground. The end of July or beginning of August is the time when the ravages of the fungus are most conspicuous, and at those periods whole fields of potato plants are often rapidly reduced to the condition of withered straw.

WE have received from the Minister of Mines of New South Wales the report of the Chief Inspector of Mines for the year

1882. Besides the usual statistics, a great part of the report is occupied with suggestions for the improvement of the present law of the colony for preventing accidents to workmen in mines.

FROM a comparison between the lists of birds observed at Salt-dalen in Norway by the ornithologist Sommerfeldt, from 1805 to 1825, and those which are now found in the district, it would appear, according to Herr Hageman of the Norwegian Forest Department, that the smaller singing birds are much more largely represented now than formerly. The ortolan and crossbill, *Hirundo urbica* and *rustica*, the common sparrow and the chaffinch, which are now abundant, were then unknown in the district, while the common sparrow was only observed on one occasion by Sommerfeldt. Herr Anda ascribes the present increase in numbers and species to the better cultivation of the land and the clearing of the fir-woods.

THE additions to the Zoological Society's Gardens during the past week include a Kinkajou (*Cerculeptes caudivolvulus*) from South America, presented by Mr. H. V. Brackenbury; a Syrian Fennec (*Canis famelicus* ♀) from North Africa, presented by Mr. J. H. James; a Blau-bok (*Cephalophus pygmaeus* ♀) from South Africa, presented by Mr. Ernest Honey; a Slender-billed Cockatoo (*Nymphicus tenuirostris*) from Australia, presented by Mrs. A. C. Biddle; an Earl's Weka Rail (*Ocydromus carlii*) from North Island, New Zealand, presented by Mrs. Wilson; two Wood Owls (*Syrnium aluco*), British, presented by Mr. J. Metcalfe; two Black Guillemots (*Uria grylle*) from Ireland, presented by Mr. H. Becher; a Vervet Monkey (*Cercopithecus lalandii* ♂) from South Africa, a Moor Macaque (*Macacus maurus* ♂), a Bonnet Monkey (*Macacus radiatus* ♀) from India, two Common Snakes (*Tropidonotus natrix*, var.), European, a Spotted Cavy (*Caloenys paca*), two Hairy-rumped Agoutis (*Dasyprocta prymnolopha*) from Guiana, deposited; a Black Howler (*Myiotes caraye* ♂) from Brazil, purchased; a Japanese Deer (*Cervus sika* ♂), a Burrhel Wild Sheep (*Ovis burrhel* ♀), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSE OF AUGUST 28-29, 1886.—This great eclipse is a return of that of August 17-18, 1868, which was extensively observed in the Bombay and Madras Presidencies and in other parts of its track from Aden to Torres Straits. In 1886 the track of the central line is mainly over the Atlantic Ocean, and at that portion of it where the duration of totality is longest it will not be observable on land. It is therefore of interest to examine the possible conditions of observation. In deducing the results which follow, the places of the sun and moon have been taken from the *Nautical Almanac*, where Newcomb's corrections to Hansen's Lunar Tables are introduced. As will be seen from the Ephemeris, the central eclipse commences in longitude 79° 46' west of Greenwich, and latitude 9° 48' north, off Colon, in the isthmus of Panama, thence running in the direction of the Windward Islands across the northern parts of New Grenada and Venezuela; passing over the Island of Grenada, it traverses the Atlantic, and meets the coast of Africa in the Portuguese possessions, not far from St. Philip de Benguela, and crossing South Africa to Sofala, it ends on the east coast of Madagascar. At Cartagena the duration of totality is 3m. 2s., with the sun at an altitude of 5°; at Maracaybo the duration is 2m. 57s., with the sun 9° above the horizon. The southern extremity of the Island of Grenada will have the most advantageous conditions for observation, having regard to length of totality and accessibility. The total eclipse begins there at 7h. 11m. 0s. a.m. on August 29, and continues 3m. 42s., the sun being at an altitude of 20°; at the northern extremity of the island the length of total eclipse is about five seconds less. In Carriacou, the principal island in the Grenadines, the duration of totality is 3m. 21s.; at the northern point of Tobago it is 1m. 51s. On the Atlantic, where the sun is on the meridian at the middle of the eclipse, or in longitude 14° 27' west and latitude 2° 57' north,

totality, according to the elements we have adopted, will continue for 6m. 31s. Near St. Philip de Benguela, on the central line, we find the sun will be hidden for 4m. 23s., but the locality will hardly attract observers. It would rather appear that we must look for observations of this eclipse to the Windward Islands only. The small island of Blanquilla is close upon the central line, but the sun has of course a less altitude there than in Grenada.

The eclipse of August 7-8, 1850, one of the same series, was observed in the Sandwich Islands, the whole track of totality lying on the Pacific.

TEMPEL'S COMET, 1873, II.—According to M. Schulhof's corrected elements of this comet's orbit, which assigned a period of revolution of 5'200 years, at the last appearance in 1878, the next perihelion passage, neglecting the effect of perturbation, which can hardly be very material during the present revolution, may take place about November 19 under circumstances that will render observations difficult if they are practicable at all. Assuming the comet to be in perihelion on November 19'5 G.M.T., we should have about the following positions:—

1883.	R.A.		N.P.D.		Log. Δ.		Log. r.		Intensity of light.	
	h.	m.	h.	m.						
Oct. 18'5	16	38'8	108	59	0'275	...	0'142	...	0'146	
Nov. 19'5	18	33'1	114	1	0'286	...	0'127	...	0'149	
Dec. 21'5	20	36'4	113	0	0'313	...	0'142	...	0'124	

In 1873, under an intensity of light of 0'385, the comet was the *extremum visibile*, in a fine sky, with a 7-inch refractor.

SOLID AND LIQUID ILLUMINATING AGENTS

THE *Journal of the Society of Arts* publishes in a recent number an interesting lecture given by Mr. Leopold Field, F.C.S., on "Solid and Liquid Illuminating Agents." Mr. Field not only deals with the chemistry of these bodies, but he gives also a most interesting account of the means of lighting in use among the ancients, to which a brief reference may be made.

The earliest known method of illumination was in all probability that of the torch, formerly used largely in northern countries, and doubtless still furnishing the Lapp and the Finn with their light. The torch is cut from the pitch pine, and around it clings the exuded resin. When lighted it burns with a large red flame, producing a great deal of smoke. Used for cooking purposes a brand might get saturated with fat, so that it would burn longer without consuming its own fibre.

This, as pointed out by Mr. Field, was the old method of lighting. Substituting for their brand a piece of rope and saturating this with pitch or resin we get the modern link, connecting us on foggy days with the old modes of lighting. The work link itself, and probably also the idea, comes from the Greek *λύχνος*, or perhaps the Latin *luchnus* (Cicero) as the German *fackel* comes from the Greek *φάκελος* (faggot), a bundle of sticks—after, a torch. But our own word torch is more evidently from the Latin *tortilium*, a twisted thing, now however more properly applicable to the link. Our pine torch too is obtained from the Roman *tæda*—slips of the *tæda*, or Italian pitch pine, that being the usual outdoor light of Rome; whilst *Funalia*, which Virgil tells us were used to light Dido's palace—

"—dependent lychni laqueatibus aureis
Incensi, et noctem flammis funalia vincunt."

is evidently from *funis*, a rope. Their composition was rather that of a finer kind of link, flambeaux, consisting of a centre of oakum, which was surrounded by alternate layers of rosin and crude beeswax, outside of all being a bleached coating of the latter. They were more costly than other kinds of torch, and giving a less smoky light were more generally employed for the illumination of halls, staircases, &c.

At what date this torch fell into disuse is a question which cannot be definitely answered, as in old times words applied to various illuminating agents, which have a very fixed and definite meaning in our day, were then interchangeable. In our translation of the Scriptures "candle" and "candlestick" are used indiscriminately with lamp, and, did we not know that candles proper and candlesticks were unknown at this period, we might infer that they were both in use. An explanation of this use of the words "candle" and "candlestick," however, is found in the fact that the Latin *candelabrum* and the Greek *λυχνία*, Latin *luchnuchus* (Cicero), meant "lampstand."

Again, in Matt. xxv. 1-5, where we find the parable of the Virgins, the word *λυχνος* is rendered lamp. But a study of the

etymology of the words shows that they are derived from roots signifying to shine or burn—as *candela*, *κανδήλα*, akin to *candeo*, to shine (Persian, *kandel*; Sans., *kan*)—*λύχνος*, *luchna*, from *lux*, light (Sans. *lōk*), *λάμπας*, *lampas*, probably connected with *lame*, and the Hebrew *lapad*, to shine.

But although it is doubtful at what date the torch fell into disuse, it may be concluded that it was succeeded by the lamp. We find evidence of this in studying mythology. Thus Ceres, according to the old legend, sought her daughter in hell with a torch; Apuleius makes Psyche drop hot oil on Cupid from a lamp. Whether candles proper, *i.e.* wicks surrounded with wax, were known before or after lamps had come into use is doubtful. Martial (first century A.D.) speaks thus concerning the candle:—

"Nomina *candela* nobis antiqua dederunt
Non norat parcos uncta lucerna patres."—(Ep. xiv. 43).

Here, however, torch, *i.e.* *funalia*—which the old Romans in reference to its shining qualities would rather call *candela* than *funalia*—may be alluded to. In the Greek the word *κανδήλα* is a derivation from the Latin, not being met with until it is found in the writings of Atheneus. This author lived in the second century A.C., and in his "Deipnosophistae" he says:—

"ἐμοὶ δὲ παῖ δωροδιδεῖννε ἀσπαρίου κανδήλας πρίω."

By that time, however, the rushlight had come into pretty general use, and no doubt it is to this that reference is here made.

But it is from a passage in Apuleius's *Metam.* iv, that we get the most valuable and conclusive information on this point. A noise being heard in the middle of the night, we are told that the household come in with "tædis, lucerna, sebaceis, cereis, et ceteris," that is with torches of pine, lamps, tallow candles, and wax tapers, which therefore clearly proves that candles both of wax and tallow were in use at this date. It seems, however, that the candle was probably used by the poorer people. At all events the lamp was a mark of respectability, as in another verse of Martial (Apoph. 42) we find that an apology is made for the use of a wax light instead of a lamp:—

"Hic tibi nocturnos præstabit cereus ignis
Subducta est puerio namque lucerna tuo."

Juvenal (iii. 287) also speaks of the "breve lumen candela." In the British Museum, too, there is a fragment of a large candle found in Vaison, near Orange, and said to belong to the first century A.C. Such candles were probably provided with wicks consisting of the pith of rushes rudely covered with crude wax or tallow. Candlesticks for these existed, and later on they had a spike to penetrate the butt of the candle. However, the name *candelabrum* was more generally applied to the pillar on which the oil lamp stood or from which it was suspended. Since no attempt was made to provide for the current of air so necessary for proper combustion, these old lamps smoked exceedingly, so much indeed that it was the duty of one of the slaves of the household to go round each morning and wipe the soot from the pictures and statues. In one case, however, at the Erechtheum of the Athens Acropolis, the lamp, which was of pure gold, was provided with a flue. This was a very large lamp, requiring to be filled but once in a year. Callimachus designed it for the new temple about 400 B.C., but the smoke was found to be so great an evil in anything designed for such a purpose, that the lamp was provided with a chimney in the shape of a bronze palm-tree inverted. But however magnificent and elaborate the design, it is certain that the economy of the lamp remained stationary.

It was generally filled with olive oil and provided with a wick either of oakum, or of the dearer Carpasian flax (cotton?). Occasionally, Pliny informs us, bitumen was used to fill the lamp; Italy, in some parts, being rich in springs of that mineral and petroleum. Further east, and especially among the tribes dwelling on the shores of the Dead Sea, bitumen and naphtha were much used as illuminating agents, and for other purposes. It may be suggested that the sacred pit-fire Nepti was of this nature. The well-known Egyptologist, Mr. Basil Cooper, has suggested the following as the origin of the word naphtha, viz. *NA*, water, of *Phtha*, the Hephaestus, or Vulcan of Egypt's deities, the god of fire. This idea receives some support from the fact that the Indians who sold the first petroleum as Seneca oil, and used it largely in their rites of worship, termed it fire-water, which name is now applied to alcohol.

Herodotus (ii. 62), writing of the *Lychnokaie* (feast of lamps) at Sais, in Egypt, in 450 B.C., only expresses surprise at the number of the lamps, and not at the lamps themselves, so that by this time they were getting into general use. Although their